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(54) IMPROVEMENTS IN AND RELATING TO PIPE INSULATION

(71) We, WIRSBO BRUKS AKTIEBOLAG, a Company organised and existing under the laws of Sweden of S-730, 61, Wirsbo, Sweden do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to insulation for pipes and has particular reference to an insulation construction for buried pipes to be used in district heating installations.

With the rapid increase in the price of fuel and energy, conservation of existing energy and heat resources has become very much more important. In the era of cheap energy, waste heat from industrial processes was frequently discharged into rivers and the environment in general.

With, however, the substantial increase in the price of fuel, means of conserving waste energy from industrial processes has become more important. In the more temperate climates of the world, it is feasible to use waste heat from industrial processes for the district heating of homes, dwellings and places of work. In achieving this; it is necessary to transport heat over considerable distances by means of pipelines and in order to conserve the maximum amount of heat in such an arrangement, adequate insulation of such pipelines has to be provided.

The use of metal pipes for the transmission of hot water and fluid has long been known and a variety of insulation coverings has been provided for such pipes. With the advent, however, of the extruded cross-linked polyolefin pipe, different systems and techniques have become possible. Instead of the pipe being laid in a series of straight pieces, the pipe is now unrolled from a roll and is simply laid around the desired contours. In these circumstances, a different technique for laying the pipes and a different kind of insulation is required over that hitherto employed.

The prior art methods involved principally forming the pipeline first and then simply coating the insulation on the outside of the pipeline. This was done by a combination of wrapping the pipeline to prevent corrosion of the outer surface thereof and thereafter coating the pipeline with a layer or thickness of insulating material or simply burying the pipe in a matrix or loose fill of the insulation material.

Prior art insulators are expensive and in many cases not entirely satisfactory since, of course, the gradual take up of moisture by the insulation material results in a deterioration of the insulation properties and a corresponding increase in the corrosion problems of the pipe itself.

According to the present invention there is provided a pipe insulation member comprising a longitudinal block of insulating material having a water resistant outer surface and an inner surface wherein the inner surface is defined by a substantially planar surface extending between extremities of the block and having one or more longitudinally extending pipe accommodating recesses adapted to accommodate a half cross-section of a pipe or tube a longitudinal groove in spaced parallel relationship with said pipe accommodating recess or recesses and spaced inwardly of a first longitudinal edge of the inner surface and a longitudinal projection in spaced parallel relationship with said pipe accommodating recess or recesses and spaced inwardly of a second longitudinal edge of said inner surface whereby a pair of similar pipe insulation members can be disposed one with respect to the other with the inner surface in juxtaposition so that the projection on one engages the recess of the other and the pipe accommodating recess or recesses cooperate to define a tubular pipe accommodating cav-

ity or cavities, and wherein a first end of the member is provided about the outer surface thereof with a longitudinally projecting flange and wherein the second end is provided with a corresponding rabbet defining a central projection whereby when two or more members are placed in end-to-end relationship the flange on one engages and mates with the rabbet on the next adjacent member.

It is preferred that the projections have a cross-sectional width slightly greater than the width of the corresponding groove whereby a positive engagement between the groove and the projection may be effected. The mating insulation members may be sealed in mating disposition by means of a sealant or adhesive applied to each groove and/or recess, in order, on locating the members one with respect to the other, to secure the components in mating relationship.

The inner surfaces and the recesses in the inner surface are preferably covered with a thin layer of metal foil to prevent diffusion of water vapour into the insulation material itself. In a particular embodiment of the present invention, the inner walls of the construction may be covered with an aluminium foil, each surface of which is coated with a polyethylene layer to protect the aluminium foil against corrosion. The aluminium foil can be glued or otherwise secured to the insulating material during the manufacture of the members.

The outer surface of each insulation member preferably comprises a generally planar outer surface in spaced relationship with the inner surface and having contoured or rounded corners merging to the longitudinal sides of each member.

The insulating material may be of any suitable material having high insulating properties. Polyurethane has been found to provide adequate insulation commensurate with reasonable cost and the insulation material itself may be impregnated to reduce or resist water penetration and to increase resistance to attack by vermin.

The recesses may accommodate pipes of any cross-sectional configuration but the recesses are preferably half-cylindrical cross-section in each member, so that a pair of members in their opposed location define a longitudinal cylindrical pipe accommodating recess.

Longitudinal lengths of insulator may be joined one to the other by means of a polyethylene foil tape which may be further covered in bitumen. A first tape joint may be formed between two consecutive lengths of insulation material placed end to end and the whole coated in bitumen and then a layer of polyethylene aluminium foil tape is applied to the joint to strengthen and bind the joint.

The preferred length of each member is of the order of 1 metre since this permits ease of handling, and the pipe may be a cross-linked polyethylene pipe.

The invention also includes a method of forming an insulated pipeline which comprises laying a plurality of pipe insulation members in accordance with the present invention in end to end interlocking relationship to define longitudinally extending pipe accommodating recesses or recess over a plurality of elements and with the grooves disposed on a first side and the projections on a second side, laying the pipe in the pipe accommodating recesses applying upper members to the members accommodating the pipes so that the projections on the lower members engage with the recesses on the upper pipe insulation members.

It is preferred that the end joints of the upper pipe insulation members be staggered with respect to the joints between the lower pipe insulation members. After applying the upper members the taping and sealing of the joints may be completed and the culvert or trench in which the pipes are layed may be backfilled in the usual way.

Following is a description by way of example only and with reference to the accompanying drawings of methods of carrying the invention into effect.

In the drawings:—

Figure 1 is a perspective view of a pipe insulation member in accordance with the present invention;

Figure 2 is a section through a pair of mating members in accordance with Figure 1;

Figure 3 is a perspective view of a culvert accommodating an insulated pipeline formed from the pipe insulating members in accordance with the present invention.

Figure 4 is a detail of an alternative embodiment of the member of Figure 1.

Figure 1 shows a longitudinal block 10 of insulating material such as polyurethane having an outer surface indicated generally at 11 and a substantially planar inner surface 12. The outer surface is defined by a planar surface 13 in spaced parallel relationship with the inner surface 12 and a pair of sides 14 and 14′ which are in upward continuation of outer surface 13 via radiused edges 15.

The inner surface 12 has a pair of longitudinally extending spaced parallel recesses 16 each of semi-circular cross-section. Each longitudinal recess being spaced symmetrically of the longitudinal axis of the inner surface 12. The surface 12 has towards its first edge 17 a longitudinally extending groove 18 of substantially square cross-section disposed in spaced parallel relationship with each of recesses 16. The surface 12

towards the second side edge 19 has an upstanding projection 20 which is also of substantially square cross section the lateral dimension of upstanding projection 20 being slightly larger than the internal lateral dimension of groove 18.

The inner surface of groove 18, surface 12 recesses 16 and the projection 20 are covered with a layer of aluminium foil having a coating of polyethylene on each surface. Thepolyethylene layer has a thickness of the order of 10 microns and may typically be the polyethylene coated foil used extensively in the packaging industry and in telecommunications as sheathing foil. The layer of polyethylene serves to provide corrosion protection for the aluminium foil. The aluminium foil itself provides resistance to the ingress of moisture vapour from the pipe accommodating cavities to the interior of the block 10.

The longitudinally extending groove 18 has a bead of sealant 22 disposed in the base thereof. The sealant may be an asphaltic composition. A layer of wax paper may be provided over the surface 12 of the block 10 in order to prevent inadvertent adhesion between blocks in a stack prior to assembly.

The outer surface 11 of the block 10 is rendered water resistant by a covering of a layer of silicon paper and/or an asphaltic layer.

In operation, a pair of blocks 10 are disposed one to the other so that the projection 20 on one enters the groove 18 on the other and the recesses 16 mate to define longitudinally extending pipe accommodating cavities within the blocks. Such an arrangement is shown in Figure 2 in an embodiment having three pipe accommodating cavities. At the same time, the sealant 22 in groove 18 adheres to the upper surface of projection 20, so that the assembled insulation has a line of sealant 22 extending of each side of the pipe accommodating cavities (see figure 2).

In the laying of a pipeline a trench or culvert is first dug and the lower insulation members 30 are laid to accommodate the pipe. In the Specific embodiment, the pipelines of crosslinked polyethylene pipe 31 are then laid in the continuous recesses and the upper insulation members 32 are then applied. The upper insulating layers are preferably staggered by one half their longitudinal length with respect to the lower insulation members 32. The upper insulating layers are preferably staggered by one half their longitudinal length with respect to the lower insulation members 30 so that the joints between the upper members are offset with respect to the joints between the longitudinally adjacent lower members. The joints themselves are sealed by means of aluminium foil tape coated with polyethylene and the insulation members are coated with bitumen to provide a watertight seal.

The embodiment shown in Figures 4A and 4B has at a first end a peripheral flange 31 extending longitudinally of end 10 about the external walls 32. A second end 10' has a peripheral rabet 33 about the periphery of the member defined by the external walls so that similar members juxtaposed end to end can be positively located one with respect to the other by the interengagement of flange 31 on one member with rabet 33 on the next adjacent member. A bead sealant is preferably provided on the internal surface of flange 31 in order, on jointing with the next unit to effect a seal between flange 31 and the projection 34 defined by rabet 33. The sealant may be an asphaltic or bitumenous composition.

Extensive testing has shown that insulation members in accordance with the present invention provide a facile means of laying pipe material and its use in conjunction with a pipe of crosslinked polyethylene forms excellent insulation and results in very low heat losses.

WHAT WE CLAIM IS:—

1. A pipe insulation member comprising a longitudinal block of insulating material having a water resistant outer surface and an inner surface wherein the inner surface is defined by a substantially planer surface extending between extremities of the block and having one or more longitudinally extending pipe accommodating recesses adapted to accommodate a half cross-section of a pipe or tube a longitudinal groove in spaced parallel relationship with said pipe accommodating recess or recesses and spaced inwardly of a first longitudinal edge of the inner surface and a longitudinal projection in spaced parallel relationship with said pipe accommodating recess or recesses and spaced inwardly of a second longitudinal edge of said inner surface whereby a pair of similar pipe insulation members can be disposed one with respect to the other with the inner surface in juxtaposition so that the projection on one engages the recess of the other and the pipe accommodating recess or recesses cooperate to define a tubular pipe accommodating cavity or cavities, and wherein a first end of the member is provided about the outer surface thereof with a longitudinally projecting flange and wherein the second end is provided with a corresponding rabbet defining a central projection whereby when two or more members are placed in end-to-end relationship the flange on one engages and mates with the rabbet on the next adjacent member.

2. A member as claimed in claim 1 wherein each projection has a cross-

sectional width slightly greater than the width of the corresponding groove whereby positive engagement between the groove and the projection is effected.

3. A member as claimed in any preceding claim including a layer of sealant or adhesive in each groove and/or recess in order, on locating the members, one with respect to the other, to secure the members in mating relationship.

4. A member as claimed in any preceding claim wherein the inner surface and the recesses therein are covered in a thin layer of metal foil to prevent diffusion of water vapour into the insulation material itself.

5. A member as claimed in claim 4 wherein the metal foil is aluminium flil which is provided with a coating of polyethylene to protect the foil against corrosion.

6. A member as claimed in any one of the preceding claims wherein the insulation member is formed of polyurethane.

7. An insulation member substantially as herein described with reference to and as illustrated in Figures 1 to 3 and 4 of the accompanying drawings.

8. A method of forming an insulated pipeline which method comprises laying a plurality of pipe insulation members as claimed in any one of the preceding claims in end-to-end interlocking relationship to define longitudinally extending pipe accommodating recesses or recess extending along a plurality of the members with the grooves disposed on a first side and the projections disposed on the second side, laying the pipe in the pipe accommodating recesses, applying further insulating members as claimed in any one of the preceding claims to mate with the first layer of insulation members so that the projections on the lower members engage with the recesses on the upper pipe insulating members.

9. A method as claimed in claim 8 wherein the butt end joints of the upper layer of pipe insulation members is staggered with respect to the butt end joints in the lower pipe insulation members.

10. A method as claimed in claim 8 or claim 9 wherein after application of the upper layer of members to the lower layer of members, the joints are taped and sealed.

11. A method as claimed in claim 8 and substantially as herein described with reference to the accompanying drawings.

12. A pipeline laid by the method claimed in any one of claims 8 to 11.

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1 538 550 COMPLETE SPECIFICATION
3 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

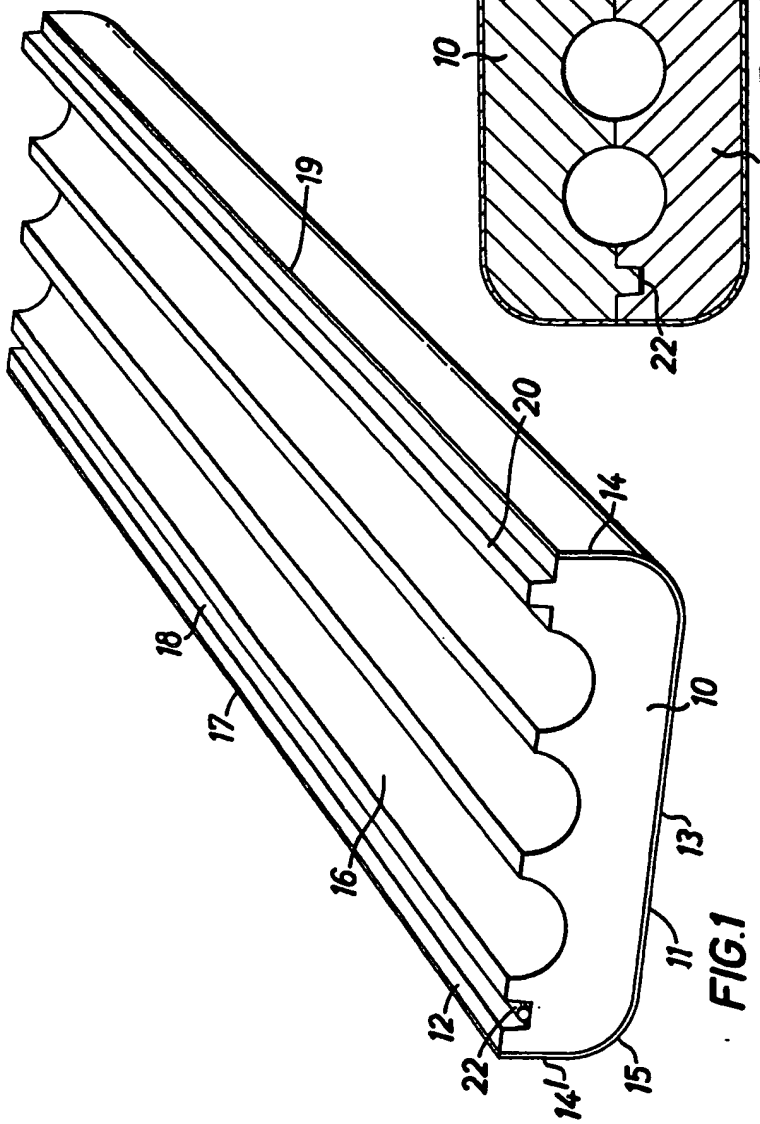

FIG.1

FIG.2

1538 550 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

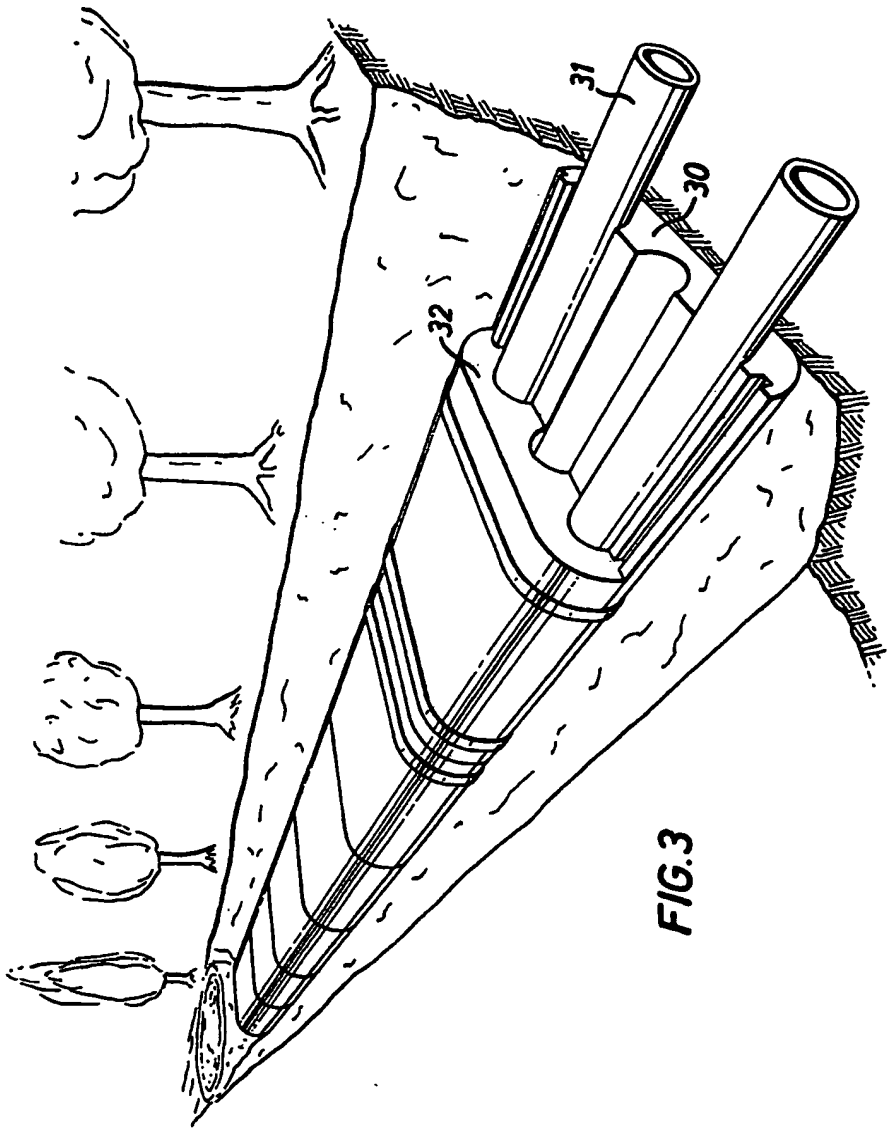

FIG.3

1 538 550 COMPLETE SPECIFICATION
3 SHEETS

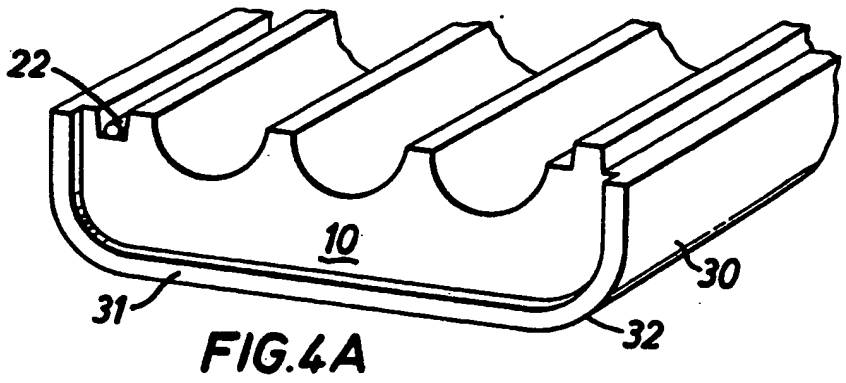

FIG.4A

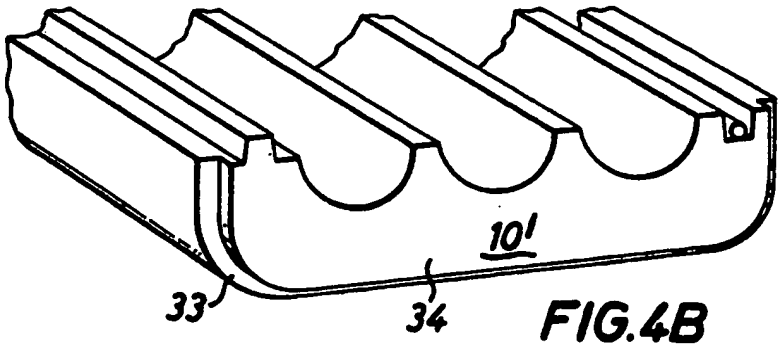

FIG.4B